EQUIPPING AND ARRANGING AN EOC

Leading Community Risk Reduction

Equipping and Arranging an Emergency Operations Center (EOC) for Miami Township

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CERTIFICATION STATEMENT

I hereby certify that this paper constitutes my own product, where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

Signed: _____

Abstract

The problem is that Miami Township has not yet determined how its recently constructed EOC will be arranged, what equipment will be needed to make the EOC functional, and has no cost estimate prepared for making the EOC functional. Until these issues are resolved, the EOC will be unable to serve its intended and necessary function. The purpose of this research was to develop, through the use of the evaluative research method, initial recommendations for arranging and equipping the Miami Township EOC in order to promote effective and efficient management of local emergencies. In order to accomplish this goal, a review of relevant literature, a search for government mandates or standards pertaining to EOC arrangement and equipment, and interviews with Montgomery County Office of Emergency Management and Ohio Emergency Management Agency personnel were conducted. The information collected was used to answer the following primary research questions:

1. Do any county, state or federal mandates or standards exist that apply to the arrangement and equipping of a local EOC?
2. Is there a particular arrangement or layout that lends itself best to use at the local EOC level?
3. What equipment and technology are required for the Miami Township EOC to efficiently function and properly interface with Montgomery County and state of Ohio emergency management resources?
4. Is there a cost estimate that can be used to begin the budgeting process for equipping the Miami Township EOC?

The study revealed no mandated EOC standards but identified helpful state funding guidelines. Many possible arrangements were identified, but no data was discovered that would

indicate any particular floor plan was preferred. A list of communications, audiovisual, and computing equipment necessary for a fully functional EOC was developed and cost estimates for purchasing the identified equipment prepared and found to be comparable of costs found in the literature. Eight Miami Township specific recommendations to implement the findings of the study were made.

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Introduction

Miami Township recently completed the construction of a new Township Administration Building on the Township's main government campus. The new building includes a moderately sized room intended to serve, in conjunction with other areas of the new building, as the Township emergency operations center (EOC). The problem is that the Township has not yet determined how the EOC will be arranged, what equipment will be needed to make the EOC functional, and has no cost estimate prepared for making the EOC functional. Until these issues are resolved, the EOC will be unable to serve its intended and necessary function.

The purpose of this research is to develop, through the use of the evaluative research method, initial recommendations for arranging and equipping the Miami Township EOC in order to promote effective and efficient management of local emergencies. In order to accomplish this goal, a review of relevant literature, search for government mandates or standards pertaining to EOC arrangement and equipment, and interviews with Montgomery County Office of Emergency Management and Ohio Emergency Management Agency personnel will be conducted. The information collected will be used to answer the following primary research questions:

1. Do any county, state or federal mandates or standards exist that apply to the arrangement and equipping of a local EOC?
2. Is there a particular arrangement or layout that lends itself best to use at the local EOC level?
3. What equipment and technology are required for the Miami Township EOC to efficiently function and properly interface with Montgomery County and state of Ohio emergency management resources?

4. Is there a cost estimate that can be used to begin the budgeting process for equipping the Miami Township EOC?

Background and Significance

Miami Township Division of Fire and EMS is a full service, combination type fire department that provides fire, emergency medical, and fire prevention services to the residents, guests, and business of Miami Township, OH. The Division currently responds to over 3800 requests for service annually from four fire stations. Three stations are staffed around the clock daily, while a fourth is operated primarily as a paid-on-call station but staffed as personnel strength allows. The Division operates nine frontline pieces of equipment that include three engines, one aerial, three frontline medic units, a medium duty rescue, and a shift commander's vehicle.

Miami Township, located immediately south of Dayton, is home to approximately 25,000 residents and 600 core businesses. During peak retail seasons, the daytime population of the Township swells to an estimated 60,000+. The Township is uniquely dichotomous, having approximately 50% urban/suburban high density neighborhoods and 50 % rural/farm low density areas. It is the home of two large regional Christian schools, several nursing homes and assisted living centers, many hotels, a sea of apartments and condominiums, and many traditional neighborhoods.

Miami's 600 core businesses are the retail hub of Montgomery County and account for approximately 50% of the annual sales tax revenue generated in the county. Miami Township is home to the regional headquarters of both Met Life and National City Mortgage; home to the corporate headquarters of LexisNexis, a major online information provider; and, home to Isotec, a specialty chemical Division of Sigma-Aldrich that manufactures isotope enriched specialty

chemicals. Additionally, there and several local and regional manufacturers and businesses rooted in Miami Township.

Several regional and national transportation corridors run through Miami Township. The east side of the Township is home to two heavily traveled state routes, SR 741 and SR 725. On average, nearly 60,000 vehicles pass through the intersection of these two routes daily. Interstate I-75 and I-675 meet in the east side of the Township and are traveled heavily by both car and truck traffic (150,000+ vehicles per day). I-75 is a major north-south interstate/international highway that runs from the Canadian border at Sault Ste. Marie, MI to Miami, FL. I-675 is the primary route to the Wright-Paterson Air Force Base, in many measures the largest air force base in the world. The flight path of much of the air traffic originating from Wright-Patterson is over Miami Township. Additionally, Dayton Wright Brothers Air Port is located within the Township. Dayton Wright Brothers is a commercial and general aviation airport that houses helicopter operations, international cargo, and private jet services. The west side of the Township is traversed by mainline rail tracks for both the CSX and Norfolk Southern railways. Over thirty trains traffic through this corridor, transporting a significant quantity of hazardous material.

The region and Miami Township have experienced both weather and non-weather related emergencies of significance over the past several decades. In July 1986, a CSX train derailed resulting in a now infamous (“Miamisburg,” 2005) phosphorous leak and explosion. The derailment caused a white phosphorus leak, fire, and explosion that caused the evacuation over 25,000 people from Miami Township and three other contiguous communities (“Derailed Tanker,” 1986). The incident, which has been cited as the largest evacuation in Ohio history (“Miamisburg, OH,” 2006), resulted in over one billion dollars in law suites and is often cited as

a classic example of a large scale hazardous materials release (Thampi, Donkin, Ingerman, Ruoff, Duerksen-Hughes & Richter, 1997).

In September 2003, Miami Township and Miamisburg experienced another large scale chemical release on their border (Sandlin, 2003). This time the incident involved Isotech, a wholly owned subsidiary of Sigma-Aldrich Corporation that produces isotope enriched specialty chemicals. The incident began as a small release of nitric oxide from a vacuum jacketed distillation column that was contained within a 300 foot deep well casing. The release was quickly contained by plant staff in a manner that had been previously used to contain similar leaks (US Chemical Safety and Hazard Investigation Board, 2004). Approximately two hours after the leak had been stopped, the distillation column exploded without warning. The explosion, which was recorded on seismic activity recorders in the area, annihilated the distillation column and propelled concrete and steel debris as far as 1,000 feet. One large steel panel from the distillation column blast containment structure was forced into a 52,000-pound gaseous carbon monoxide (CO) tank. The impact of the steel on the CO tank knocked the tank from its mountings and pushed it approximately 10 feet, severing fill lines to the tank and causing a CO fire. Additionally, there was damage to other similar processes that were active at the facility, resulting in an evacuation order lasting nearly 24 hours for over 2,000 residents of Miami Township and the City of Miamisburg.

In addition to the demonstrated potential for large scale fixed site and transportation related emergencies, the region has also been the victim of many natural disasters of varying proportions. Over the last few years, parts of the Township have been exposed to small scale flooding along the Great Miami River that flows through the Township on its way to the Ohio River. Recent flooding along the river has caused isolated damage to homes, parks, and crops in

the area but has been primarily controlled by flood control provisions put in place after a devastating flood that damaged the entire region in 1913. However, a potential exists for flooding that could exceed the capacity of the levy and dam system that has been constructed.

Additionally the area has been plagued by tornado activity over the years. In 1974, the town of Xenia, which sits approximately 20 miles from the Township, was hit by an F5 tornado in what is now referred to as the "Super Outbreak" by people in the weather industry. During this outbreak, 148 tornados raged across the heart of the country in less than 24 hours. The storms left 330 dead and over 5,000 injured (National Oceanic and Atmospheric Administration, 1999). Xenia was struck by the deadliest of these storms, an F5 storm that killed 33 people. The same area was again hit in September 2000 (Xenia, n.d.) by a killer tornado that claimed the life of one and injured 100. As recently as 12 July 2006, the region was hit by several small F0 – F1 storms. One of those tornados passed directly adjacent to the Township's main government campus that includes Miami Township Police Headquarter, the Douglas J. Zink Fire Administration Building and main station, and the Township Administration Building. The storm damaged buildings in the area, ripping the roof off a building directly across the street from the campus (Bennish et al., 2006).

Both the region and Miami Township have a demonstrated potential for both man made and natural disasters. Perry (1991), recognizing the importance role of an emergency operation center (EOC) in disaster response, called the EOC the "key to disaster response" and emphasized the link between emergency planning and managing disaster response. Similalry, Neal (2005), notes EOCs are "the key facilities used to manage disaster response. The Township similarly recognizes the ability of a well equipped EOC to minimize the impact of disasters on its

community. As part of its ongoing all hazard emergency planning, the Township has constructed and now moves to equip a new EOC.

This project relates directly to the goal of the National Fire Academy's Leading Community Risk Reduction course to develop a comprehensive multihazard risk-reduction plan for over 2,500 communities, led by or including the local fire service. Additionally, the project directly links to the United States Fire Administration's operational objective to promote within communities a comprehensive, multihazard risk-reduction plan led by the fire service organization.

Literature Review

Considering the assertions of Neal (2005) and Perry (1991) that EOCs are critical to the efficient and effective management of disasters, the technical literature related to the topic is surprisingly sparse. Perry (1995) called attention to the fact that there was in fact little technical literature relating to EOCs available. In his 2003 work, Perry noted that the use of EOCs poorly understood. Similarly, Neal (2003, 2005) noted the limited and meager knowledge available to the emergency management community on EOCs. While the body of literature regarding EOCs is decidedly limited in comparison to other topics of interest, this body offers the only current information by which communities seeking to operate effective EOCs can turn to make decisions with regard to designing and operating EOCs.

The earliest scholarly work done on EOCs was done by the staff of the Disaster Research Center (DRC). The DRC, a social science center dedicated to the study of disasters, was established at Ohio State University in 1963 and relocated to the University of Delaware in 1985. The Center's research focuses exclusively on organizational and community preparation for, response to, and recovery from disasters and community crisis and has resulted in the publication

of over 400 publications on these topics. E. L. Quarantelli, one of two founding directors of the DRC, was one of the first to specifically study EOCs and their function.

In one of his earliest works, Quarantelli (1972) identified a group of functional problems with EOC that had been derived from the field study of nearly 100 disasters conducted during the previous 10 years. His observations focused on the who, what, where, and when's of an EOC. In addition to identifying some fundamental breakdowns in the operation of EOCs, in this work Quarantelli first identifies the six primary tasks or functions of an EOC. (see Table 1.) In a later more complete work he based on the studies of 275 emergency situations, Quarantelli (1978) refined his observations and elaborated on the six major functions carried out by EOCs. Similarly, he further refines and condenses his observations on EOCs as part of a more general report on disaster response and planning (Quarantelli, 1979).

In a 1985 report commissioned by the Federal Emergency Management Agency, Quarantelli revisited the general topic of local disaster management services and noted that most of the same issues identified during studies of disasters in the 60's and 70's continued to exist. Wenger, Quarantelli, and Dynes (1986) assessed the effectiveness of disaster response in six community disasters based on six dimensions including the EOC. They concluded that emergency response was clearly aided by a fully staffed and adequately equipped EOC. They emphasized the need for adequate communications equipment, work space, critical resources such as maps and resource inventories.

In the International City Management Association (ICMA) text on Emergency Management, Perry (1991) focuses on the importance, function, location, and structure of an EOC. In his text, Perry further refines the six primary functions of an EOC identified by

Table 1

Quarantelli's Primary EOC Tasks

Functions	Description
Coordination	Those tasks that are directed at effectively relating organizations to one another and organizational capabilities to the disaster needs.
Policy making	Those tasks that involve creation of broad reaching policy by key decision makers.
Operations	Those tasks that specifically address the needs of the disaster response.
Information gathering	Those tasks that are focused on determining the nature and extent of disaster conditions. These tasks are now commonly referred to as damage assessment.
Public information dispersal	Those tasks that focus on informing the general public and media.
Hosting visitors	Those tasks that manage the VIPs and other visitors to the EOC.

Quarantelli (see Table 1) and identifies two common patterns for management of a local EOC during a disaster. In one management style, the local EOC is managed by an EOC coordinator or emergency manager. This manager consults with staff, develops policy recommendations for elected and appointed leadership, clears and implements these policies. In the alternate management style, policy is devised by either the EOC coordinator or an emergency

management committee comprised of directors of key departments and representatives of the chief administrator in consult with the other. The policy is cleared by the emergency management committee through elected officials and implemented by the EOC coordinator. Additionally, Perry identifies the need for an EOC to be capable of housing folks for extended periods of time and to meet their sanitary, billeting and nutritional needs during this period. Perry emphasizes the need for telephone and radio communications and identifies the need for expanded radio channel capacity and phone lines.

Perry's 1995 work provides similar insight. In 2003, Perry expanded his analysis and insight on EOCs considering the demand for communities to be prepared for consequence management associated with terrorist events. In this work he places the operation of an EOC into the context of the well know Incident Management System (IMS), elaborating on the function of the finance, logistics, planning and operations sections of an EOC. McHugh (1995) describes similar organization and functioning in his account of Tucson, AZ flooding.

In one of the most complete works on EOCs, Moore (1998) walks the reader through the entire process for developing an EOC. This work reviews the six primary functions of an EOC developed by Quarantelli (1972) and refined by others and discusses the necessity for selecting a location and that limits potential threats as well as designing a structure that will withstand anticipated weather events. The work provides general guidelines for equipping an EOC and a cost estimate for doing so. Additionally, Moore describes four commonly used floor plans for EOCs. Botterell (2002) and Neal (2003) similarly describe five floor plans in use by EOCs to facilitate operations. Additionally, several internet reports of EOC construction and equipment cost estimates were located (Burnett & Spak, 2005; City of Detroit, n.d.; McCaleb, 2001).

Moore (1998) also compared and contrasted what he called two major organizational arrangements used in EOCs across the country. The first model, referred to as the ESF model, is based on numbered emergency support functions (ESF). These essential support functions are completed by support teams lead by a specific agency. These ESFs may be directly related to those used in the National Response Plan (U.S. Department of Homeland Security, 2004) or other similarly structured response plan. This organizational structure allows for EOC to EOC interoperability to the extent that the jurisdictions utilize the same ESF system. The alternate model is termed the traditional model by Moore. In this model, resources and support is title under general disciplines represented in the EOC. Typically these disciplines will include fire, law enforcement, utilities, health, and so forth. Moore notes that this particular model allows for a high degree of flexibility in an EOC. Visits to both the Ohio EOC and the Montgomery County EOC, revealed that both are primarily arranged by ESF but are, to a limited extent, also able to function in a more traditional model when necessary to interface with local EOCs.

Neal (2003, 2005) has focused primarily on location, space, layout, and noise issues in his work. He draws attention to problems with noise in EOCs resulting from overcrowding and lack of room capacity and notes the need to develop strategies for noise control in EOCs. He also notes the wide range of recommendations for square footage per person operating in an EOC. Larson (2003), writing about EOC's in action, covers issues such as recording EOC activity, activating/deactivating the EOC, and EOC security concerns. Larson's work in 2006 examines facilities needs for today's EOCs. In this work, he emphasizes the technological needs and expense associated with developing a functional EOC. Additionally, Larson addresses the topic of virtual EOCs, noting that every management decision does not require in person attendance.

Similarly, Kubin, Skapski, & Sheardown (2002) also briefly address virtual EOCs in their work. Green (2000) and Davis (2002) dedicate entire works to defining and analyzing the virtual EOC.

There are many consultants that currently work in the emergency management and response field. Many of them have proprietary information available to clients, potential clients, or colleagues. Steve Davis of All Hands Consulting, (personal communication, July 31, 2006) provided a nearly 50 page prepared packet of EOC information that included a list of common mistakes to avoid when constructing an EOC that include failing to place a raised floor in your EOC and elimination of facilities necessary to feed and billet your EOC staff.

Several recent National Fire Academy Executive Fire Officer Program applied research projects that addressed the one or more parts of this project were obtained. Tomblin (2005) noted that there were no Illinois or federal standards for EOCs. Similarly Lemeke (2005) noted that there were not federal mandates or Nevada mandates for EOCs. He also developed a generic list of infrastructure, logistical and technological needs of an EOC. Sinnott's work (2005) focused on threats that could impact the ability of the EOC to function and staffing issues.

The Federal Emergency Management Agency (FEMA) offers several resources that are valuable to a agencies developing EOCs. FEMA's EOC Assessment Checklist (2006) was initially developed to be used with FY 2002 EOC grant guidance and has been updated and is now available through the Department of Homeland Security Office. The Checklist poses a series of questions that help operators of state and local EOCs assess hazards, vulnerability and risk to their existing EOCs. Further more, it assesses the need for certain capabilities and to what extent that capability is present. A case study on the Smith County, TX, EOC and 911 Communications Center (FEMA, 2003) highlights essential functions of an EOC and describes the process of researching and building a hardened EOC facility. The case study emphasizes

construction to stringent wind resistance recommendations contained in FEMA 361 Design and Construction Guidance for Community Shelters (2000). Additionally, FEMA's Emergency Management Institute offers courses in the management and operation of EOCs. The FEMA texts (1995a & 1995b) for theses course offer a wide array of general information on developing and staffing EOCs.

Finally interviews with Montgomery County Office of Emergency Management Director Jeff Jordan and State of Ohio Emergency Management Agency (OEMA)Engineer Steve Rosner were conducted at the Montgomery County and State of Ohio EOC's. The interviews primarily focused equipment and software interoperability, organization, and communication capability. Similar to the FEMA EOC Assessment Checklist referenced earlier, OEMA (2005) provided a design and criteria recommendation document that was initially developed to provide guidance for local communities applying for federal/state EOC development grants.

Procedures

Information and data for this project were gathered in several manners including an extensive literature review, interviews, and personal observations, procedures for each are described below.

Literature Review

An extensive literature review on EOCs was completed. The review utilized the Learning Resource Center at the National Fire Academy and its LRC online card catalog. The catalog was searched for references to both "EOC" and "emergency operations center." Abstracts for the search results were reviewed and culled. Literature that appeared relevant to this project was then gathered through local libraries, electronic access, reprint and text purchase, and direct contact with authors to access works. Additionally, internet search engines were used to search the

internet for the similar terms. Yahoo, Google, and site search engines such as FEMA's search engine and the University of Delaware D Space were used to locate potential references. Several primary references lead to the acquisition of additional reference materials. The literature review resulted in the acquisition of text books and manuals including FEMA EMI course texts, books, technical reports, newspaper articles, peer reviewed journal articles, published government technical reports, and web posted information.

Interviews

As part of this project, the Montgomery County Office of Emergency Management Director Jeff Jordan and the State of Ohio EOC Facility Engineer Steve Rosner were interviewed. Director Jordan was interviewed at the Montgomery County EOC July 21 2006 and SCM Engineer Rosner was interviewed on August 6, 2006 at the State of Ohio EOC. Each person interviewed was called prior to the interview to arrange an acceptable time and each was asked the same basic questions with follow-up and probing questions were asked when initial responses generated a need to gather further information.

1. Are there any federal or state mandated EOC design, layouts, or equipment? Can you show me the various areas that comprise your EOC?
2. Is your EOC organized by ESF or in a traditional format and why is it organized in that fashion?
3. What radio, computer, and audio-visual equipment are in use in your EOC?

The interview subjects were selected specifically for their technical expertise relating to the two EOCs the Miami Township EOC is most likely to exchange information with. Within the emergency management structure, Montgomery County is the Township's direct tie to the Oho

EOC, and it is imperative that the Township can effectively communicate with that EOC on every level.

Personal Observations

Personal observations were conducted at both the State and Montgomery County EOCs during and after interviews with their representatives. Observations specifically focused on a few key factors.

1. What was the physical layout/floor plan of the EOC? What rooms comprised the EOC?
2. What technology was in use within the EOC to facilitate its operation?
3. What ration of phones and radios to seating positions existed in the EOC?
4. Where there any particularly remarkable or noticeable features in the EOC?

In addition to the observations, digital photos of equipment and facilities were taken where valuable for reference during manuscript production.

Limitations

Despite the critical nature of EOCs, there are relatively few systematic scholarly studies of how these facilities operate or what they need to be effective. EOCs are sporadically used, designed to meet community specific needs that vary widely, complex and thereby inherently difficult to study. Additionally, while the study of other EOCs can be valuable in a more general sense, specific information most likely to impact the effectiveness of any specific EOC is most likely going to be obtained by studying the agencies and EOCs that particular center is going to interact with. Local EOCs are most likely to interact with their county EOCs and State EOCs, providing a limited study set.

Results

EOC Standards and Mandates

The fist question posed in this study was, “Do any county, state or federal mandates or standards exist that apply to the arrangement and equipping of a local EOC?” A review of the literature identified no county, state, or federal mandates applicable to the arrangement and equipping of a local EOC. Interviews with those identified above confirmed the lack of specific government mandates. However, in order to qualify for federal/state EOC grant funding, EOCs in Ohio must meet some minimum criteria (see Table 2), creating a mandate for those interested in applying for funding assistance.

Effective Layout

The second question posed in this study was, “Is there a particular arrangement or layout that lends itself best to use at the local EOC level?” Personal observation of both the Montgomery County (OH) and State of Ohio EOCs revealed that both facilities currently use a multi-room layout as set forth in the Ohio criteria for EOCs (see Table 2). Each has separate executive/policy/lead agency rooms and also separate communications rooms. The County EOC has radio communication at most seating positions in addition to the radio capability in the communications room. All positions have telephone capability. The operations room of both the State of Ohio EOC and the Montgomery County (OH) facilities are both arranged in what is could be termed a “cluster” approach. In this cluster arrangement, the agency representatives are grouped by their ESF, as defined by the Ohio Emergency Response Plan. Interviews revealed that each of these EOCs is set up in this way to facilitate effective communication between their EOC and the upstream EOC.

Table 2.

Ohio EOC Grant Funding Mandatory Criteria

Category	Requirements
Location	• Located so effects of local hazards minimized. • Located outside the 100 yr flood plain.
Size	• Sized overall to handle maximum anticipated staff based on community population. • Sized at a minimum of 50 square feet per person with 80 square feet preferred.
Design	• Meets Ohio Basic Building Code including “essential facility” seismic requirements. • Emergency power generator capable of powering EOC and all facilities including HVAC, elevator, computer systems. Generator must be equipped with automatic start up and transfer capabilities.
General Facility	• Day-to-day office space for EMA Director & staff. • Designated meeting/lead agency/executive breakout room. • Communications room for radio, phone, & support. • Operations room for emergency coordination. • Restrooms. • Mechanical/electrical switch room. • Kitchen/break area. • Storage area for maps, procedures & supplies.

Table 2 *(continued).*

Ohio EOC Grant Funding Mandatory Criteria

Category	Requirements
Operations Room	• Telephone lines and logs. • Status display capability (large manual or visual) • Computers, intranet, internet, and network capabilities for automatic data processing. • Seating for one to two people per assigned agency. • 30 square feet per person minimum area.
Communications Equipment	• Telephone lines for each agency and level of government in the operations room. • Telephone lines for other support areas. • Telephone lines for computer modems. • Fax machine and dedicated line. • LAN system. • Weather monitoring capability. • Emergency Alert System (EAS) Access • Capability to activate local warning systems. • Lightning protection for facility and antenna. • Radio (and tower) with frequency capability for police, fire, health, Environmental Protection Agency, utilities, Red Cross, public works, hospitals, etc.

While the observations of Moore (1998), Botterell (2002), and Neal (2005) all provide descriptions of a number of EOC layouts, the determination of what layout an individual community chooses is based primarily on logic or personal exchanges between EOC representatives (Neal, 2003). However Neal (2003) points out that because there is a lack of systematic study of EOCs, there is simply no data that points to an particular layout or arrangement as being the most effective.

Equipment and Technology

The third question posed in this study was, "What equipment and technology are required for the Miami Township EOC to efficiently function and properly interface with Montgomery County and state of Ohio emergency management resources?" The Ohio EMA *Design Recommendations and Criteria for Emergency Operations Centers* (2005) document serves a starting point for developing the required technology and equipment list for the Miami EOC. In that document, Ohio EMA provides a graph that is used to estimate the maximum staff that would occupy the EOC in the event of major emergency as a function of community population. Using that plot, Miami should expect to staff their EOC with a maximum of 17 to 22 personnel during a major disaster based on resident and daytime populations estimates. Based on this estimate, a maximum EOC operations room occupancy of 20 was utilized. A list of necessary EOC equipment is contained in Appendix A.

Personal observations at the state and county EOC, along with the recommendations of many found in the literature, indicate that dedicated personal computers for EOC staff are essential to efficient functioning in today's EOC environment. EOCs observed have computer capability at each ESF function and a few additional within their EOCs. However, each EOC is designed to

Table 3.

EOC Cost Estimates

Location	Cost ($ k) (2006 dollars)	Notes
Columbus, OH (state EOC)	$17,600.0	• Total construction and equipment costs for State EOC and communication center.
Madison, WI (state EOC)	$525.0	• $187 k AV budget
City of Detroit, MI	$483.4	• Technology only budget
Orange County, FL	$347.7	• Remodel of existing facility with technology upgrade
City of Naperville, IL	$314.8	• EOC equipment
Montgomery Co., OH	$195.0	• $93 k AV budget • Excludes furniture, portable radios ($300 k), phones, raised floor, no dispatch capability
City of Longview, TX	$191.3	• EOC equipment

hold far more people than ESFs. For the purpose of developing an equipment list, a 2:1 ratio of occupants to computers was developed.

Literature accounts, personal observation, and interview results indicate that the ability to display status visually on the walls of the operations center is vital to information sharing and

communication. Typically these displays are three or more in number and are either large flat panel plasma displays or overhead LCD projectors. Interviews and observation reveal that the use of LCD projection units lends itself best to varying input signal between computer and television signals. Switching equipment necessary to allow input from computers, television sources, and a sound system necessary for accompanying audio is also essential.

Radio communications with assets is critical to operations center functionality. Because of the wide array of radio equipment in use among agencies and organizations, there is a need to ensure interoperability. Local 800 MHz System, MARCS, regional VHF, regional UHF, and amateur radio capability is needed. Locating an EOC immediately adjacent to a dispatch center is ideal. When this is not possible a basic dispatch capability is often needed by an EOC staff.

Cost Estimates

The fourth question posed in this study was, "Is there a cost estimate that can be used to begin the budgeting process for equipping the Miami Township EOC?" A literature review in conjunction with interviews revealed a wide array of EOC costs. Costs, adjusted to 2006 dollars using the US Bureau of Labor Statistics inflation calculator (http://data.bls.gov/cgi-bin/cpicalc.pl) can be found in Table 3. Examination of the figures in Table 3 do reveal that equipping an EOC with today's audiovisual, radio, and radio equipment will cost in the upwards of $200,000. A rough cost estimate to equip a Miami Township EOC in the manner described in Appendix A is contained in Appendix B. Based on cost estimating, the Township can expect to expend approximately $305,000 to equip a fully functional EOC.

Discussion

Neal (2005) noted that very little empirical data existed on internal design and seating arrangements, and equipping EOCs. This project similarly found a near complete lack of specific

guidance and standards that apply to EOCs. Additionally, there are less than a handful of systematic scholarly studies of EOCs that are decades old. Considering the importance of such centers and their limited use, it seams reasonable to expect that more developed guidelines for EOCs would be developed by state and federal agencies. For example, the author can envision, at a minimum, a typing system for EOCs based on capability and equipment similar to systems used to type much of the nation's emergency response assets. The lack of EOC standards and typing standards hampers the ability of effective EOCs to be developed.

The State of Ohio Design Recommendations and Criteria document (2005), while only five pages in length, appears to be one of the most helpful criteria documents available. The document appears to be consistent with nearly all the recommendations for equipping or setting out a floor plan for an EOC that were identified in the literature reviewed earlier. This study did identify one suprising disagreement between FEMA recommendations and Ohio requirements. The FEMA (2003) case study and the corresponding design and construction guidelines (FEMA, 2000) for community shelters indicate that facilities in our region should be designed to the 250 mph standard. This wind standard is based on the likelihood of tornado activity in the region. The Ohio guideline, to which the Miami facility is constructed, requires design wind speeds of only 90 mph. Structures designed to this 90 mph wind standard would likely sustain extensive damage if struck by a strong F1 or greater tornado. Considering Ohio's devastating losses during the infamous "super outbreak" of tornados, this recommendation seams inconsistent with historic indicators. A second notable item is also missing form the Ohio list, a dispatch capability. While radio capability is a requirement, the ability to specifically dispatch units is not a require criteria. Perry (2003) and Moore (1998) place an emphasis on the ability to dispatch from the EOC, especially in larger communities.

Finally, the results indicate that in order to have a fully functioning EOC, the Township will have to commit to a substantial outlay of funds at a time when economic times in the region are difficult. However, the disaster history of the region and the current potential for disaster demand an operational EOC. Utilizing a properly equipped EOC will, in the long run save tax payer money in the event of a disaster.

Recommendations

Based on the findings of this project, the following recommendations with regard to the arrangement and equipping of the EOC are made. Some recommendations refer specifically to rooms of the new Administration Building. The entire second floor of the building was designed to be used in the event of EOC activation. Additionally, many parts of the first floor could be used to augment that space effectively. (see appendix C for floor plans of the building) During the construction phase, the communications room identified in the floor plans for the EOC was converted into a computing and utility room and is no longer available (see Figures C2, C3).

Recommendation 1. Convert what was initially designed to be an EOC break room into a communications room (Figure C3). Immediate access to radio communications is essential to the functionality of an EOC.

Recommendation 2. Equip the communication room of the center with a suite of basic dispatch equipment including UHF radio, VHF radio, amateur radio, receptionist's telephone set, satellite phone and a dispatch console tied to the main Miami Township Dispatch Center.

Recommendation 3. Install an appropriate suite of antennae on the Administration Building. The antennae suit must be lightning protected and include 800 MHz antennae directed at both the primary and back up sites for the Montgomery County radio system.

Recommendation 4. Equip the operations room (Figure C3) with furnishings to accommodate 20 personnel comfortably during activation. A 20 person EOC team is appropriate for our size community and limiting the furnishings will limit noise, and avoid over crowding. Extra furnishings could be stored in the storage room adjacent to the operations room if it is desired for secondary functions of the room. Furnishings should be movable to ensure maximum flexibility during an emergency. Sleeping cots should be purchased and stored for potential lengthy EOC activations.

Recommendation 5. Consider installing sound absorbing flooring in the operations room. EOC noise levels are sited often in the literature as conditions that interfere with effective functioning of an EOC. The hard surface flooring in this room combined with phones, radios, and coordination activities will likely lead to distracting noise in the room if unchanged.

Recommendation 6. Equip the operations room with audiovisual equipment as indicated in the EOC equipment list included in Appendix A. This should include four LCD projectors and screens, white boards, wireless and wired LAN systems, weather monitoring capability, cable/satellite TV feeds and local 800 MHz radio capability.

Recommendation 7. Equip the EOC with 11 laptop computers to be used by EOC staff during activation. Laptop computers are preferred over tower conventional units for three primary reasons. First, they take up less work space in the EOC while in use and computers not in use can easily be stored to create even more open work space for the staff members. Second, the use of laptops in conjunction with the existing wireless LAN results in maximum flexibility during EOC set up. Finally, the use of laptops allows staff, who may need to change location during an activation, to take their work station with

them. For example, a public information officer may be need to be in the operations room during some periods of time, in briefings with the executive staff, or outside the press briefing room preparing for a press conference. The computers should be loaded with basic office software, weather monitoring software (minimum one machine), the Ops Center EOC software used by the County and Ohio EOCs (ten machines), and Reverse 911 alerting software (multiple machines). Additionally, two low end laser printers should be located in the EOC on the LAN for printing.

Recommendation 8. Plan to utilize first floor meeting room (Figure C1), designated "elected officials" as a rumor control room for the preparation of media releases and fielding of media calls. This will keep PIO functions from interfering with normal operations room activities and place the PIO close to the community room which is designed to be used for press events. This room is also to the secure stairwell to the executive room and the second floor EOC facilities.

Implementation of these recommendations, coupled with appropriate training and exercises, will enhance the ability of Miami Township to effectively manage and respond to disasters that hit the Township or region.

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Appendix A: EOC Equipment List

Telephone and Fax Equipment.

The addition of a receptionist's position in the communication room of the EOC and 10 phone sets in the Operations room of the EOC will be necessary. (10 based on one phone per two EOC occupants at estimated maximum capacity) Consideration should be given to running phone service out of the EOC to two separates switching stations to increase the likelihood that a small to medium size disaster does not inhibit phone communication from the EOC. Additionally, at least one dedicated fax machine should be located in the EOC communication room on a dedicated fax line. At least one satellite phone should also be available. Additionally, the agency should give serious consideration to adding priority phone calling to all Nextel style phones issued to employees which would give them priority service during an emergency.

Computing Equipment

Personal computers for operations room of the EOC. To accommodate operational flexibility, the computers should be wide screen laptop units capable of utilizing the existing wireless or wired LAN present. Units should be loaded with standard Windows Office programs and GIS software. At least two base level printers should be available in the EOC and access to other printers in the building possible. This system will also allow access to the Reverse 911 system the Township currently operates, allowing for emergency notification of Township residents. Additionally, weather data should be available in the EOC though a dedicated computer/display system.

Status Display Equipment

Install four overhead LCD projection and screen systems capable of displaying video and audio signal from computers being utilized in the operations room or television. The capability to record input video is also desirable. Additionally, the availability of several white boards placed in the remaining wall space is necessary for posting additional information.

Radio Equipment

The EOC must have the capability to communicate on several radio platforms, including the Montgomery County, Warren County, and Dayton City platforms. Additionally, there is a state wide interoperability radio system in Ohio originally called the MARCS (Multi-Agency Radio Communication System) and amateur radio systems the EOC must have capability on. To support these radios, and appropriately installed, grounded, and lightning protected antenna system is necessary. For Miami, this antenna system must include directional 800 MHz antenna's aimed at our primary and backup radio sites. Finally, Montgomery County EOC has a bank of nearly 80 portable 800 MHz radios available for use by EOC members and those interacting with the EOC.

Furnishings

The EOC will need to be furnished with tables, work stations, and chairs. A review of the literature suggests that having some flexibility in the EOC floor plan can be beneficial during non-emergency and disaster scenarios. With this in mind, work stations should be comprised of movable tables and chairs selected for the EOC should be as comfortable as possible for participants.

Appendix B: Miami EOC Equipment Cost Estimate

Table B1.

Miami EOC Cost Estimates

Item	Est. Cost
Status Display Package (four LCD projectors, screens, mounts, audio system for the room and switching equipment to facilitate the viewing of computer and television signals in the EOC and white boards .)	$100,000
Radio Suite (UHF, VHF, and amateur radio control bases; MARCS, Montgomery County 800 MHz radios (4), satellite phone)	$24,000
Antennae Suit (lightening protected multi-antennae package to accommodate radio suite.)	$22,000
Furnishings (tables, chairs, storable cots, storage racks)	$20,000
Computer Package (11 laptop computers; 2 laser printers; basic software operating system and office suite; one set weather monitoring software)	$25,000
Ops Center Software (EOC/emergency management software utilized by the Ohio EOC and Montgomery County EOC)	$9,000
Dispatch Console (configured like current dispatch center consoles and wired through the fiber runs back to dispatch.	$39,000
Portable Radio Cache (includes 12 ruggedized Motorola type III portables, Impress chargers and batteries)	$55,000
Interoperable Radio Interface for EOC (interoperability rack and basic cabling)	$10,000

Appendix C: Miami Township Administration Building and EOC

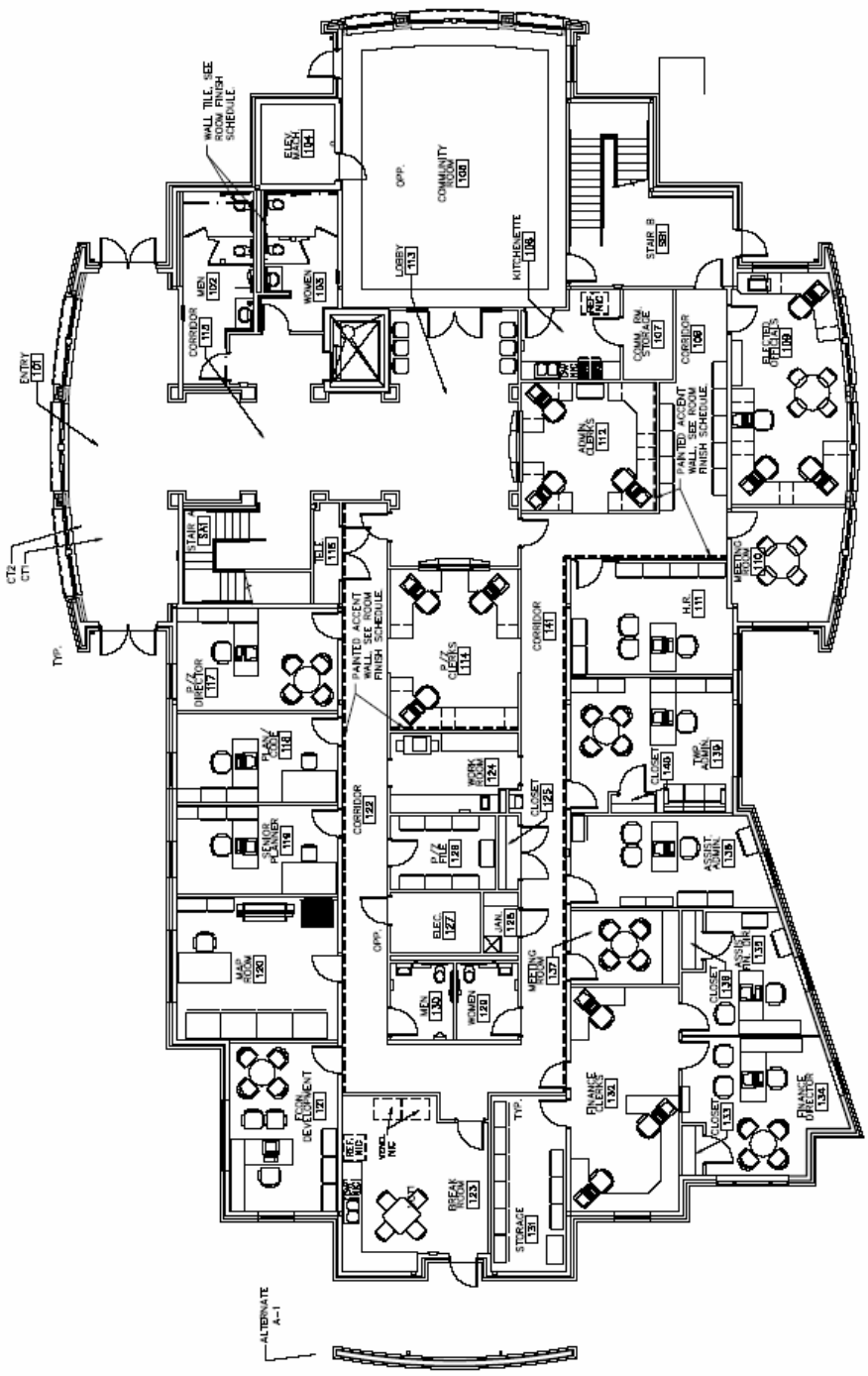

Figure C1. Administration Building Ground Floor

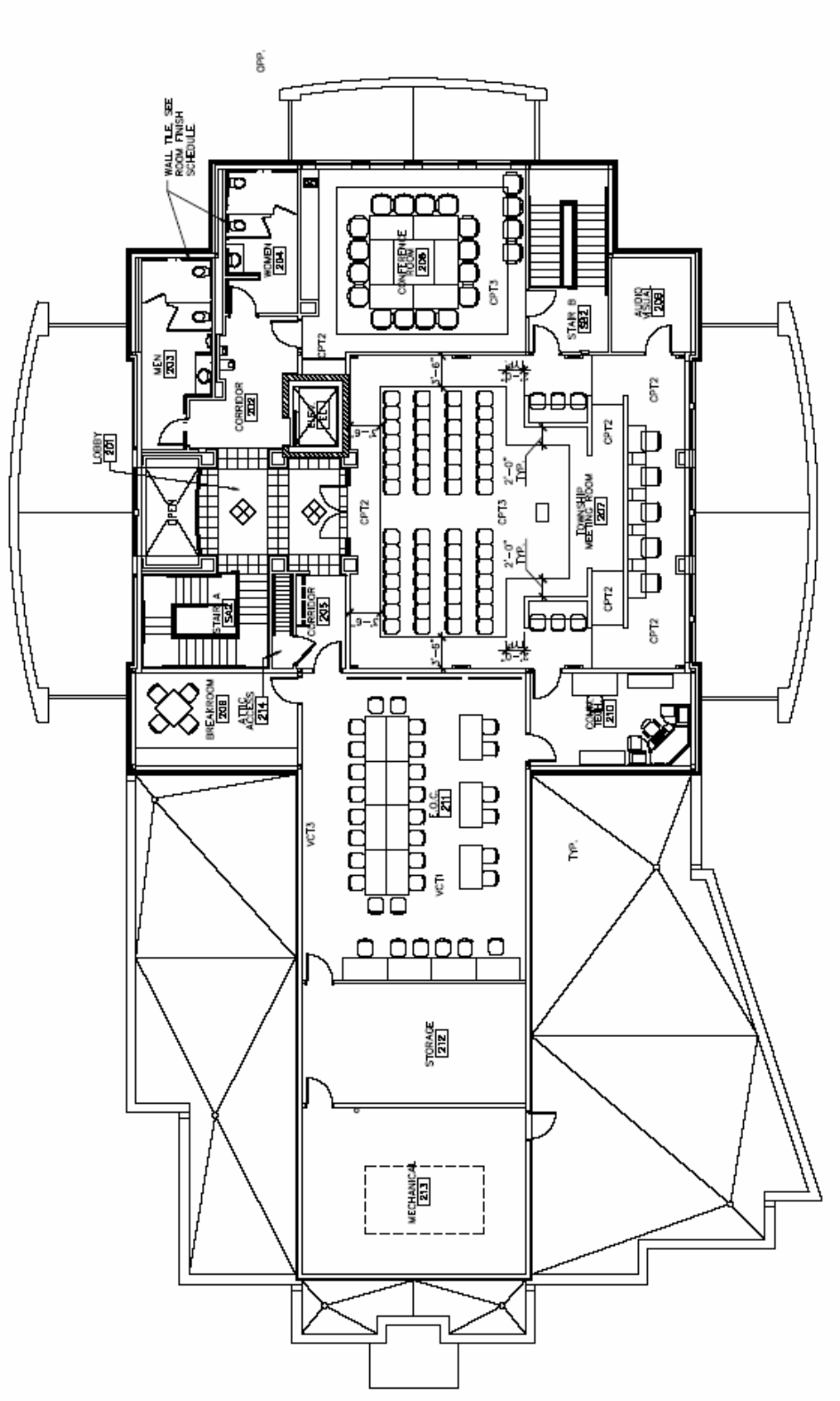

Figure C2. Administration Building Second Floor

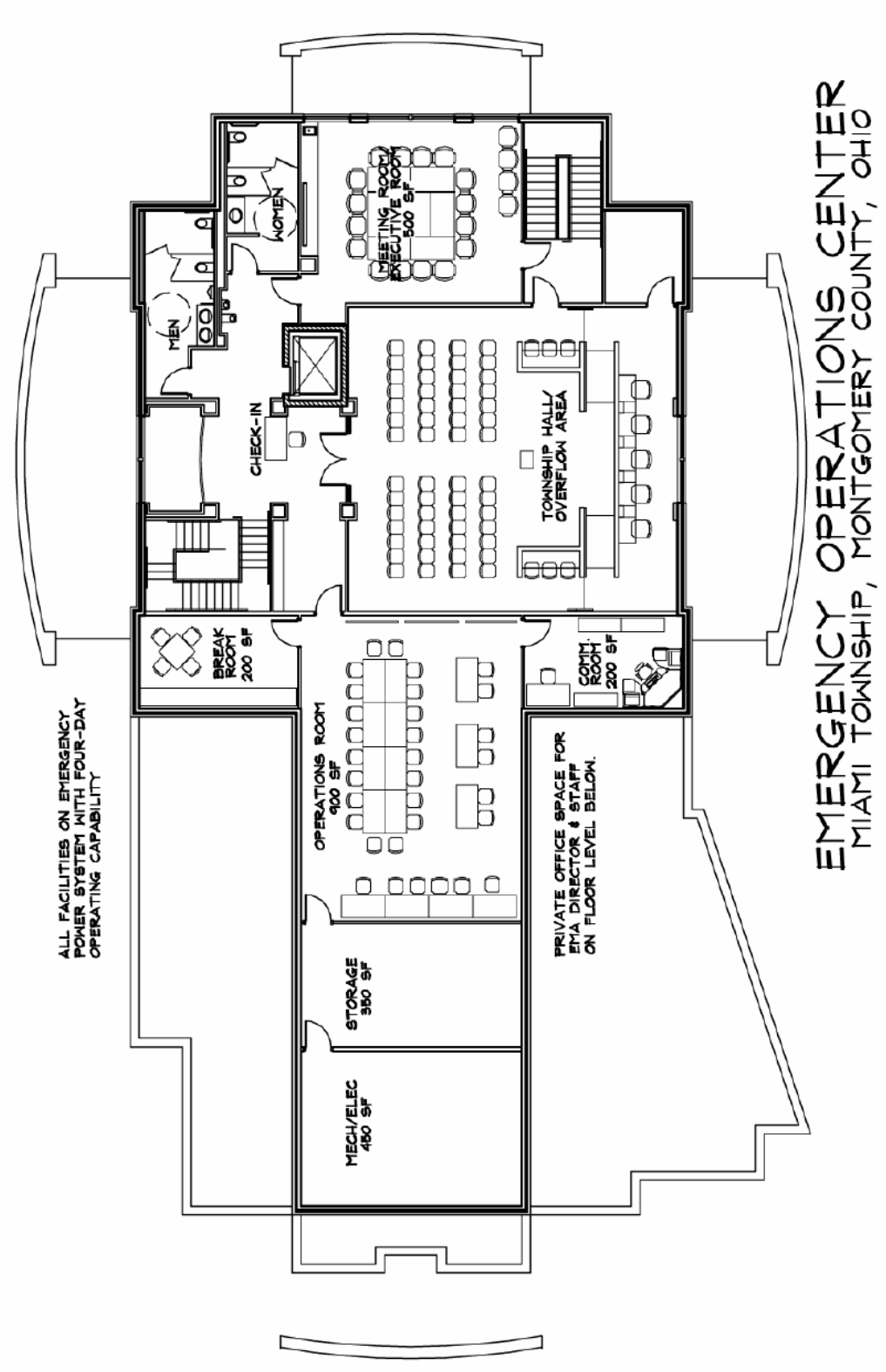

Figure C3. Emergency Operations Center Design